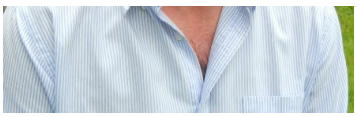
Exhibit 56



Excellence Award, the (UK) Biochemical Society's Teaching Excellence Award, the (UK) Physiological Society's Otto Hutter Teaching Prize, and Fellowship of the British Pharmacological Society & its Zaimis Prize.

Posted in **Career**, **Career Development**, **Collaboration**, **Community of Practice**, **Course Design**, **Curriculum**, **Professional Development**, **Teaching Strategies**, **Undergraduate Physiology** on **August 25, 2021 [https://blog.lifescitrc.org/pecop/2021/08/25/the-capstone-experience-implementing-lessons-learned-form-a-pandemic-educational-environment-to-create-inspirational-real-world-educational-experiences/]** by **Margaret Stieben** (**Posts** | **Profile**)
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Exhibit
073

AUGUST 18TH, 2021

The Olympics, sex, and gender in the physiology classroom

The recent Tokyo Olympic Games present an opportunity for a number of intriguing discussions in a physiology classroom. Typical discussion topics around the Olympic Games involve muscle strength, muscle power, aerobic fitness, bioenergetics, and a number of other physiological factors that determine athletic performance. Coronavirus, immunity, disease transmission, and similar topics may be unique areas of discussion related to the Tokyo Olympic Games. Another topic that has been prevalent in the news for the Tokyo Olympic Games is the role of sex and gender in athletic competition.

Before and during the Tokyo Olympic Games several athletes were featured in news headlines due to either gender identity or differences of sexual development (DSD, also sometimes called disorders of sexual development). Male-to-female transgender athletes competing in women's sports in the Tokyo Olympic Games include weightlifter Laurel Hubbard, archer Stephanie Barrett, cyclist Chelsea Wolfe, soccer player Quinn, and volleyball player Tifanny Abreu, (1, 2). There have also been news stories about Caster Semenya, Christine Mboma, and Beatrice Masilingi being ineligible to participate in the Olympics due to their DSD causing their serum testosterone concentrations to be above the allowed limits for female athletes (3, 4). In addition to physiology sex and gender are interwoven with culture, religion, and politics, so how to discuss sex and gender in the physiology classroom needs to be carefully considered by each instructor depending on the campus climate, policies, and individual comfort level with walking into these potential minefields. However, sex and gender in sports are very appropriate topics to discuss from a physiological perspective.

Although sex and gender have been used interchangeably in common conversation and in the scientific literature, the American Psychological Association defines sex as "physical and biological traits that distinguish between males and females" (5) whereas gender "implies the psychological, behavioral, social, and cultural aspects of being male or female (i.e., masculinity or femininity)" (6). Using these definitions can be helpful to draw a clear distinction between gender (and/or gender identity) as a social construct and sex as a biological variable, which can help focus the discussion on physiology.

As reviewed by Mazure and Jones (7) since 1993 the NIH puts a priority on funding research that includes women as well as men in clinical studies and includes an analysis of the results by sex or gender. Mazure and Jones (7) also summarized a comprehensive 2001 Institute of Medicine sponsored evaluation that concluded that every cell has a sex. A 2021 Endocrine Society scientific statement provides considerable information on the biological basis of human sexual dimorphism, disorders of sexual development, and lack of a known biological underpinning for gender identity (8). On August 12, 2021 a PubMed search using the term "Sex Matters" (in quotation marks) returned 179 results, with many of the linked papers demonstrating the importance of sex for health, disease, and overall biological function (without quotation marks there were 10,979 results). Given that there have been various discussions in the news media and across social media blurring the distinction between sex and gender, it is very important that students in physiology understand that sex in humans is an important biologically dimorphic trait of male or female.

Relevant to a discussion of the Olympic Games, the differences in performance between male and female running has been analyzed for world's best and world's 100th best (9), annual world's best performance (10), world record performance (11-13), Olympic and elite performance (13-16), High School performance in CA, FL, MN, NY, and WA (17), and 100 all-time best Norwegian youth performance (18). Hilton and Lundberg (19) also provided an excellent review of the large differences in athletic performance between men and women in numerous sports. Overall, by mid-puberty males outperform comparably aged and trained females by 10-60%, depending on the sport (see figure 1 of Hilton and Lundberg, reproduced here with no changes under the Creative Commons license https://creativecommons.org/licenses/by/4.0/).

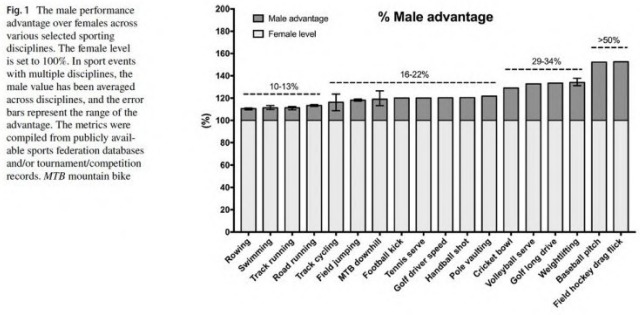

Fig. 1 The male performance advantage over females across various selected sporting disciplines. The female level is set to 100%. In sport events with multiple disciplines, the male value has been averaged across disciplines, and the error bars represent the range of the advantage. The metrics were compiled from publicly available sports federation databases and/or tournament/competition records. *MTB* mountain bike

Hilton and Lundberg (19) also reviewed the present state of research regarding the effects of male-to-female hormone treatment on muscle strength and body composition and concluded that men typically have 45% more muscle mass than women, and male-to-female hormone treatment reduces muscle mass by ~5%. These authors also concluded that men typically have 30-60% higher muscle strength than women, and male-to-female hormone treatment reduces muscle strength by 0-9%. Overall, Hilton and Lundberg (19) conclude that transwomen retain considerable advantages over cisgender women even after 1-3 years of male-to-female hormone treatment. Harper at al. (20) also reviewed the research regarding the effects of male-to-female hormone treatment on muscle strength and body composition and came to the same conclusions as Hilton and Lundberg. Harper et al. (20) further concluded that male-to-female hormone treatment eliminates the difference in hemoglobin concentrations between cisgender men and women. In a single research project, Roberts et al. (21) observed that before transition male-to-female members in the US Air Force completed a 1.5 mile running fitness test 21% faster than

comparably aged cisgender women. After 2.5 years of male-to-female hormone treatment the transwomen completed the 1.5 mile running fitness test 12% faster than comparably aged cisgender women. (Figure 1 Hilton and Lundberg)

All of the previously mentioned information is important to consider when asking if transwomen can be fairly and safely included in women's sports. It is also important to note that the effects of male-to-female hormone treatment on important determinants of athletic performance remain largely unknown. Measurements of VO2max in transwomen using direct or indirect calorimetry are not available. Measurements of muscle strength in standard lifts (e.g. bench press, leg press, squat, deadlift, etc.) in transwomen are not available. Nor have there been evaluations of the effects of male-to-female hormone therapy on agility, flexibility, or reaction time. There has been no controlled research evaluating how male-to-female hormone treatment influences the adaptations to aerobic or resistance training. And there are only anecdotal reports of the competitive athletic performance of transwomen before and after using male-to-female hormone treatment.

The safe and fair inclusion of transgender athletes and athletes with DSD in women's sports is a topic being debated in many states and countries, and by many sporting organizations including the International Olympic Committee. In the end, whether it is safe and fair to include transgender athletes and athletes with DSD in women's sports comes down a few facts that can be extrapolated, lots of opinions, and an interesting but complicated discussion. This is a worthwhile discussion in a physiology classroom because it allows a good review of the biologically dimorphic nature of human sex. However, the safe and fair inclusion of transgender athletes and athletes with DSD in women's sports is also a discussion that should be approached with caution due to the many opinions this topic entails that reside outside of physiology.

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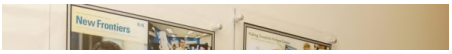

where he has been a faculty member since 2004. He is also the Director of the General Studies program at the University of Nebraska at Kearney. He earned a Bachelor of Science in Physical Education (pre-Physical Therapy emphasis) from Utah State University in 1997, a Master of Science in Exercise and Sport Science (Exercise Physiology Emphasis) from Iowa State University in 1999, and a Doctorate of Philosophy in Health and Human Performance (Biological Basis of Health & Human Performance emphasis) from Iowa State University in 2002. He is a Fellow of the American College of Sports Medicine and an American College of Sports Medicine Certified Exercise Physiologist.

Posted in **Classroom Content**, **Diversity**, **engagement**, **Teaching Strategies** on **August 18, 2021 [https://blog.lifescitrc.org/pecop/2021/08/18/the-olympics-sex-and-gender-in-the-physiology-classroom/]** by **Margaret Stieben** (**Posts** | **Profile**)
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AUGUST 11TH, 2021

The COVID-19 Pandemic: An Opportunity for Change in my Teaching

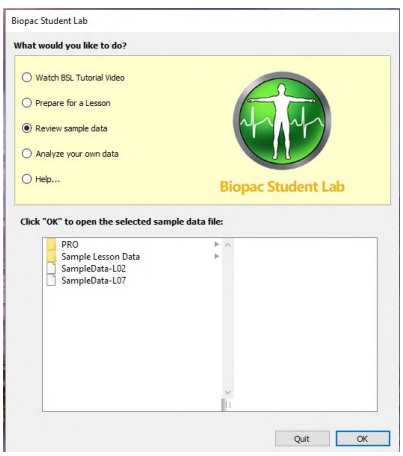
As the 2020-21 academic year ended, I sighed with relief. I had survived the switch to an online teaching format, wearing a mask while teaching when I had to have a class in-person, and the loss of my father. But as quickly as my sighs of relief subsided, I began to wonder, "What will happen next academic year?" Will I be teaching all my classes in-person, will my classes be online, or will I have some classes or labs online and others in-person? As these questions swirled in my head, I began to reflect on this past year. Teaching online was tough. There were activities that bombed. But there were activities that rocked. And there were activities that could be improved. And believe it or not, there were some great things that came from teaching online. Some had to do with content, some had to do with skills, and some had to do with community. Now comes the challenge of choosing what I should take with me, and what I should leave behind? And as I reflected, I realized there are two experiences from this past year I want to use this year, whether I am teaching in-person or online. One had to do with the idea of community and the other had to do with skills. While others came up, I decided to be kind to myself and focus on two.

1. Forming an Inclusive Scientific Community

Prior to the COVID-19 pandemic, I had never taught a course online nor had I taken a class online. I had attended webinars but had never presented an online seminar either. Now I was being asked to teach courses online to students I had never met, and these students had never met each other in-person either. When I reflected on my teaching in-person, I realized I had never worried about whether I knew the students immediately or whether they knew each other. I assumed their presence in class with me and with the other students would allow relationships to form and a learning community to be built. But now they were just images on a screen and often, just names since cameras were not always on.

Now that I was teaching online, I had to be more intentional about building a learning community. This was to help not only me but also my students. Research has shown that students do not just want to be faces in a crowd (1, 2). They want to be recognized by the professor and by their peers. And as the pandemic progressed, they needed this more personal interaction. Creating a community would foster interaction and make students comfortable to share in an online environment (1, 2). To begin, I included icebreaker activities to allow me and the students to learn more about each other. And these icebreakers were not a one and done activity. They continued throughout the first several weeks of class. As the semester continued, polls or questions replaced the icebreakers. These were questions anyone could answer. They could be content questions, well-being checks, or simple questions about plans for the weekend or favorite ice cream. All meant to foster community. When in the classroom, peer interactions can be observed by the instructor. In the online classroom, it was more difficult to monitor interactions and those who were uncomfortable with group work could disappear when the breakout rooms opened.

Including these activities online allowed me and the students to feel like we were in this class together. While I was not a student, I was no longer "The Sage on the Stage." We, the professor and the students, were in this online learning community together. When an online activity was successful, we celebrated together. If something did not work, what discussed the activity and what we could change. This community was most evident when my father fell ill and then passed away. These students I had been working with stepped up and helped me during this emotionally challenging time. While I still guided their learning, they took more on themselves, and they helped each other and me. The entire year we had spoken about grace and that we all needed to give and receive it. They gave me grace when I needed it most. Who would not want to take this community into the in-person classroom?



2. Promoting Scientific Soft Skills

With the initial move to online teaching, one of the challenges faced was laboratory experiments. Many laboratory exercises require specialized equipment (3). In my case, this was the Biopac Student Lab System®. One of the benefits of this system is that students get to record physiologic data on each other. The cost of and logistical issues regarding supervision and liability for the Biopac® home system prevented me from using this as an option. However, one of the benefits of the Biopac Student Lab System® is the free access to sample data and the free analysis software for downloading offered by the company (Figure 1). Additionally, as I had been using these systems for over 10 years, I had previously recorded student data at my fingertips (Figure 2). Students could download the software to their personal computers and open any shared data for analysis. While the students were not actually recording the data themselves, this provided an alternative for learning about physiological processes with data from subjects. This also allowed me to have the students focus more on how they presented the results and how they discussed the science behind the results. We could focus on the writing of the results and the understanding of the science because the students were no longer focusing on the possibility of user error as to why they did not get the results expected.

As I was reflecting, I realized that with lab exercises moving online that the reduction in focus on learning how to use equipment and collect data was a positive (3). This allowed students to focus on writing and